

## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2003-294033

(43)Date of publication of application : 15.10.2003

(51)Int.Cl. F16C 19/38  
F16C 19/56  
F16C 33/60  
F16C 43/04

(21)Application number : 2002-101170

(71)Applicant : KOYO SEIKO CO LTD

(22)Date of filing : 03.04.2002

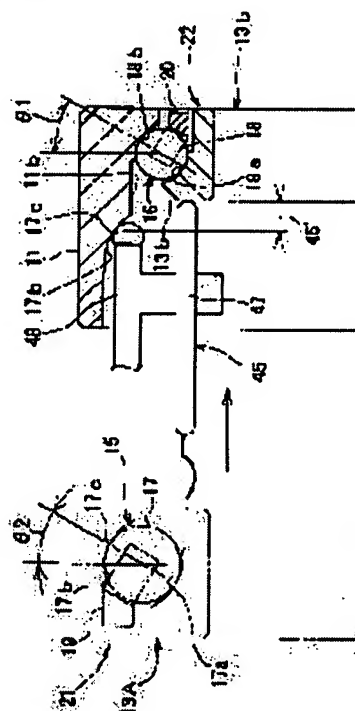
(72)Inventor : FURUSAWA SHIGEAKI

## (54) DOUBLE-ROW ROLLING BEARING AND ASSEMBLING METHOD THEREFOR

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To solve a problem in a tandem type double-row ball bearing, in which there is a difficulty to adjust a contact angle of ball in adequate values on respective rows in spite of differences for dimensional tolerance on each row.

**SOLUTION:** A contact angle  $\theta_2$  of a group of balls 16 at a small diameter raceway side in a second assembled unit 22 is set to select the second assembled unit 22 which becomes suitable for a contact angle  $\theta_1$  of a group of balls 15 at a large diameter raceway side in a first assembled unit 21. Thus, management for setting respective contact angles  $\theta_1$  and  $\theta_2$  of a group of balls 16 at a large diameter raceway side and a group of balls 15 at a small diameter raceway side as an appropriate value is facilitated in case that a nut 42 is screwed on a screw thread 40 of a shaft portion 9.



## LEGAL STATUS

[Date of request for examination] 02.11.2004

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

## \* NOTICES \*

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

CLAIMS

---

## [Claim(s)]

[Claim 1] While being arranged to this alignment within and without the direction of a path, it has a bearing washer and an another side bearing washer. The aforementioned one side bearing washer It is the single bearing washer which has a minor diameter orbit and a major-diameter orbit in the peripheral surface. Said another side bearing washer A single minor diameter orbit side bearing washer with the orbit which counters said minor diameter orbit to a peripheral surface, A single major-diameter orbit side bearing washer with the orbit which counters said major-diameter orbit is included in a peripheral surface. Said minor diameter orbit side rolling-element group by which fitting is carried out on the other hand between the minor diameter orbit of a bearing washer, and the orbit of said minor diameter orbit side bearing washer, It has said major-diameter orbit side rolling-element group by which fitting is carried out on the other hand between the major-diameter orbit of a bearing washer, and the orbit of a major-diameter orbit side bearing washer. Said minor diameter orbit side rolling-element group and a minor diameter orbit side bearing washer are attached to the aforementioned one side bearing washer from an axial center. And double row anti-friction bearing characterized by what said major-diameter orbit side rolling-element group and a major-diameter orbit side bearing washer are attached to a bearing washer from an axial center on the other hand, and said minor diameter orbit side bearing washer and the major-diameter orbit side bearing washer are installed in the direction of an axial center for.

[Claim 2] The single bearing washer which has a minor diameter orbit and a major-diameter orbit in a peripheral surface, and the minor diameter orbit side bearing washer which counters this single bearing washer in the direction of a path, The minor diameter orbit side rolling-element group arranged free [ rolling between the major-diameter orbit side bearing washer which counters said single bearing washer in the direction of a path, and said single bearing washer and a minor diameter orbit side bearing washer ], While being the assembly approach of double row anti-friction bearing containing the major-diameter orbit side rolling-element group arranged free [ rolling between said single bearing washer and a major-diameter orbit side bearing washer ] and building said minor diameter orbit side bearing washer into said single bearing washer from an axial center While fitting in said minor diameter orbit side rolling-element group between the minor diameter orbit of said single bearing washer, and the orbit of said minor diameter orbit side bearing washer and building said major-diameter orbit side bearing washer into said single bearing washer from an axial center The assembly approach of double row anti-friction bearing characterized by what is fitted in in said major-diameter orbit side rolling-element group between the major-diameter orbit of said single bearing washer, and the orbit of said major-diameter orbit side bearing washer.

[Claim 3] The end-face location of said minor diameter orbit side bearing washer which is the assembly approach of double row anti-friction bearing according to claim 2, and is beforehand built into said single bearing washer with said minor diameter orbit side rolling-element group, It is based on the direction distance of an axial center with the contact predetermined position in contact with the major-diameter orbit of said major-diameter orbit side rolling-element group. The major-diameter orbit side rolling-element group from which the contact angle of said major-diameter orbit side rolling-element group turns into a proper contact angle to the contact angle of said minor diameter orbit side rolling-element group, and a major-diameter orbit side bearing washer are chosen. The assembly approach of double row anti-friction bearing characterized by what these major-diameters orbit side rolling-element group and a major-diameter orbit side bearing washer are built into said single bearing washer for from an axial center.

---

[Translation done.]

## \* NOTICES \*

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

DETAILED DESCRIPTION

---

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to double row anti-friction bearing used for the differential equipment carried in a car, and its assembly approach.

[0002]

[Description of the Prior Art] Drawing 4 shows the cross-section structure of conventional differential equipment 100. This differential equipment 100 has differential casing 101. The pinion shaft (drive pinion) 102 is arranged in this differential casing 101. This pinion shaft 102 is supported by the tapered roller bearing 103,104 of the pair single row estranged and arranged in the direction of an axial center free [ rotation ] at the circumference of an axial center. The flange yoke 105 connected with a non-illustrated driveshaft is formed in the edge of the pinion shaft 102.

[0003]

[Problem(s) to be Solved by the Invention] With the above-mentioned differential equipment 100, the bearing supported for the pinion shaft 102, enabling free rotation consists of a tapered roller bearing 103,104. Especially, big frictional resistance works to the tapered roller bearing 103 by the side of the big pinion gear 106 of thrust loading. For this reason, running torque becomes large and the technical problem that the effectiveness of differential equipment 100 falls occurs. Then, it is possible to replace the bearing by the side of a pinion gear 106 with a tapered roller bearing 103, and to use the double row ball bearing of a tandem die.

[0004] As mentioned above, when it replaced with a tapered roller bearing 103 and the double row ball bearing of a tandem die was used, there was no double row ball bearing which is difficult for using the ball of both trains as a proper contact angle, is stabilized as differential equipment 100 by the difference in a dimensional tolerance etc., and can demonstrate the desired engine performance.

[0005]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, double row anti-friction bearing of this invention While being arranged to this alignment within and without the direction of a path, it has a bearing washer and an another side bearing washer. The aforementioned one side bearing washer It is the single bearing washer which has a minor diameter orbit and a major-diameter orbit in the peripheral surface. Said another side bearing washer A single minor diameter orbit side bearing washer with the orbit which counters said minor diameter orbit to a peripheral surface, A single major-diameter orbit side bearing washer with the orbit which counters said major-diameter orbit is included in a peripheral surface. Said minor diameter orbit side rolling-element group by which fitting is carried out on the other hand between the minor diameter orbit of a bearing washer, and the orbit of said minor diameter orbit side bearing washer, It has said major-diameter orbit side rolling-element group by which fitting is carried out on the other hand between the major-diameter orbit of a bearing washer, and the orbit of a major-diameter orbit side bearing washer. Said minor diameter orbit side rolling-element group and a minor diameter orbit side bearing washer are attached to the aforementioned one side bearing washer from an axial center. And on the other hand, said major-diameter orbit side rolling-element group and a major-diameter orbit side bearing washer are attached to a bearing washer from an axial center, and said minor diameter orbit side bearing washer and the major-diameter orbit side bearing washer are installed in the direction of an axial center.

[0006] According to the above-mentioned configuration, setting management of the contact angle of each rolling-element group becomes easy by choosing beforehand the major-diameter orbit side rolling-element group which serves as a proper contact angle to the contact angle of a minor diameter orbit side rolling-element group, and a major-diameter orbit side bearing washer.

[0007] While double row anti-friction bearing of the above-mentioned configuration builds said minor diameter orbit side bearing washer into said single bearing washer from an axial center While fitting in said minor diameter orbit side rolling-element group between the minor diameter orbit of said single bearing washer, and the orbit of said minor diameter orbit side bearing washer and building said major-diameter orbit side bearing washer into said single bearing washer from an axial center Said major-diameter orbit side rolling-element group is assembled as it fits in between the major-diameter orbit of said single bearing washer, and the orbit of said major-diameter orbit side bearing washer.

[0008] Still more preferably double row anti-friction bearing of the above-mentioned configuration The end-face location of said minor diameter orbit side bearing washer beforehand built into said single bearing washer with said minor diameter orbit side rolling-element group. It is based on the direction distance of an axial center with the contact predetermined position in contact with the major-diameter orbit of said major-diameter orbit side rolling-element group. The major-diameter orbit side rolling-element group from which the contact angle of said major-diameter orbit side rolling-element group turns into a proper contact angle to the contact angle of said minor diameter orbit side rolling-element group, and a major-diameter orbit side bearing washer are chosen, and it assembles by building these major-diameters orbit side rolling-element group and a major-diameter orbit side bearing washer into said single bearing washer.

[0009]

[Embodiment of the Invention] The case where double row anti-friction bearing (henceforth a "double row ball bearing") of this invention is made to apply to the bearing for pinion shaft support of the differential equipment attached to a car hereafter is explained to an example based on a drawing.

[0010] The sectional view of the double row ball bearing part after the assembly of differential equipment and drawing 3 of the sectional view in which drawing 1 shows the outline configuration of differential equipment, and drawing 2 are the explanatory views in the middle of the assembly of differential equipment.

[0011] As shown in drawing 1 , said differential equipment 1 has differential casing 2. This differential casing 2 consists of a front case 3 and a rear case 4, and both 3 and 4 are attached by bolt nut 2a. Among the front cases 3, the annular walls 27 and 28 for bearing wearing are formed in the way. This differential casing 2 is carrying out the interior of the pinion shaft (drive pinion) 7 which has a pinion gear 6 to the differential change gear style [ which carries out differential linkage of the wheel on either side ] 5, and 1 side. The pinion gear 6 has geared to the ring wheel 8 of the differential change gear style 5. The shank 9 of the pinion shaft 7 is formed in the shape of a stage so that the side else may serve as a minor diameter compared with 1 side.

[0012] The shank 9 of the pinion shaft 7 is supported by the annular wall 27 of the front case 3 free [ rotation ] through the double row ball bearing 10 in the 1 side at the circumference of an axial center. In addition to this, the shank 9 of the pinion shaft 7 is supported by the annular wall 28 of the front case 3 free [ rotation ] through the tapered roller bearing 25 at the circumference of an axial center in the side.

[0013] As shown in drawing 3 , while has major-diameter outer-ring-of-spiral-wound-gasket orbital plane 17b and minor diameter outer-ring-of-spiral-wound-gasket orbital plane 18b, and the double row ball bearing 10 consists of an outer-ring-of-spiral-wound-gasket member 11, and the first assembly 21 and second assembly 22 as a single bearing washer. The double row ball bearing 10 consists of attaching so that the first assembly 21 and second assembly 22 may be installed in the direction of an axial center to the outer-ring-of-spiral-wound-gasket member 11 at the direction inside of a path.

[0014] The outer-ring-of-spiral-wound-gasket member 11 is attached in the inner skin of the annular wall 27. The counter-bored outer ring is used as an outer-ring-of-spiral-wound-gasket member 11. Flat-surface section 11b which follows minor diameter outer-ring-of-spiral-wound-gasket orbital plane 18b in a minor diameter from major-diameter outer-ring-of-spiral-wound-gasket orbital plane 17b between major-diameter outer-ring-of-spiral-wound-gasket orbital plane 17b and minor diameter outer-ring-of-spiral-wound-gasket orbital plane 18b is formed in this outer-ring-of-spiral-wound-gasket member 11. Of this configuration, the inner skin of the outer-ring-of-spiral-wound-gasket member 11 is formed in the shape of a stage.

[0015] The first assembly 21 has the major-diameter orbit side ball group 15 which fits in between single major-diameter orbit side inner-ring-of-spiral-wound-gasket member 13A of another side which counters major-diameter outer-ring-of-spiral-wound-gasket orbital plane 17b of the outer-ring-of-spiral-wound-gasket member 11 in the direction of a path, and has inner-ring-of-spiral-wound-gasket orbital plane 17a, and major-diameter outer-ring-of-spiral-wound-gasket orbital plane 17b and inner-ring-of-spiral-wound-gasket orbital plane 17a. This major-diameter orbit side ball group 15 is held by the first cage 19 at \*\*\*\*\*, such as a circumferential direction. As this major-diameter orbit side inner-ring-of-spiral-wound-gasket member 13A, the shoulder dropping inner ring of spiral wound gasket is used.

[0016] The second assembly 22 has the minor diameter orbit side ball group 16 which fits in between single minor diameter orbit side inner-ring-of-spiral-wound-gasket member 13B which has inner-ring-of-spiral-wound-gasket orbital plane 18a which counters minor diameter outer-ring-of-spiral-wound-gasket orbital plane 18b of the outer-ring-of-spiral-wound-gasket member 11 in the direction of a path, and minor diameter outer-ring-of-spiral-wound-gasket orbital plane 18b and inner-ring-of-spiral-wound-gasket orbital plane 18a. This minor diameter orbit side ball group 16 is held by the second cage 20 at \*\*\*\*\*, such as a circumferential direction.

[0017] As minor diameter orbit side inner-ring-of-spiral-wound-gasket member 13B, the shoulder dropping inner ring of spiral wound gasket of a minor diameter is relatively used compared with major-diameter orbit side inner-ring-of-spiral-wound-gasket member 13A. The path of the shoulder of minor diameter orbit side inner-ring-of-spiral-wound-gasket member 13B is formed in the major diameter rather than the path of the shoulder dropping section of major-diameter orbit side inner-ring-of-spiral-wound-gasket member 13A.

[0018] Major-diameter orbit side inner-ring-of-spiral-wound-gasket member 13A is inserted in the pinion shaft 7 (eye \*\*\*\*\*). The end face in major-diameter orbit side inner-ring-of-spiral-wound-gasket member 13A is in contact with the end face of a pinion gear 6 from an axial center. Minor diameter orbit side inner-ring-of-spiral-wound-gasket member 13B is inserted in the pinion shaft 7.

[0019] The path of the ball 17 in the major-diameter orbit side ball group 15 is formed in size from the path of the ball 18 in the minor diameter orbit side ball group 16. Such double row ball bearings 10 of a configuration differ in the pitch diameters D1 and D2 of each ball groups 15 and 16, respectively. That is, the pitch diameter D1 of the major-diameter orbit side ball group 15 is set up more greatly than the pitch diameter D2 of the minor diameter orbit side ball group 16. Thus, the double row ball bearing 10 which has the ball groups 15 and 16 from which pitch diameters D1 and D2 differ is called the double row ball bearing of a tandem die.

[0020] A tapered roller bearing 25 has two or more the tapered rollers 26 of a single row and cage 25a which holds these tapered rollers 26 to \*\*\*\*\*, such as a circumferential direction, infixed between the outer-ring-of-spiral-wound-gasket member 12 of a single, the inner-ring-of-spiral-wound-gasket member 14 of the single arranged at the method of the inside of the direction of a path of this outer-ring-of-spiral-wound-gasket member 12, and the outer-ring-of-spiral-wound-gasket member 12 and the inner-ring-of-spiral-wound-gasket member 14. The outer-ring-of-spiral-wound-gasket member 12 in a tapered roller bearing 25 is attached in the inner skin of the annular wall 28. More than one are the inner-ring-of-spiral-wound-gasket member 14, cage 25a, and the thing by which the outer-ring-of-spiral-wound-gasket member 12 is independently used as an assembly, and the tapered roller 26 of a single row is attached to the outer-ring-of-spiral-wound-gasket member 12. The outer-ring-of-spiral-wound-gasket orbital plane of a tapered roller 26 is formed in the inner skin of the outer-ring-of-spiral-wound-gasket member 12, and the inner-ring-of-spiral-wound-gasket orbital plane of a tapered roller 26 is formed in the peripheral face of the inner-ring-of-spiral-wound-gasket member 14, respectively. The inner-ring-of-spiral-wound-gasket member 14 of a tapered roller bearing 25 is inserted in in the middle of the shank 9 of the pinion shaft 7.

[0021] The plastic spacer 33 for a precompression setup is infixed in edge face-to-face in the direction of an axial center of minor diameter orbit side inner-ring-of-spiral-wound-gasket member 13B of the double row ball bearing 10, and the inner-ring-of-spiral-wound-gasket member 14 of a tapered roller bearing 25. Outer fitting of this plastic spacer 33 is carried out in the middle of the shank 9 of the pinion shaft 7.

[0022] The oil circuit 30 is formed between the outer wall of the front case 3, and the annular wall 27 by the side of one, opening of the oil inlet port 31 of this oil circuit 30 is carried out to the ring wheel 8 side of the oil circuit 30, and opening of the oil outlet 32 of the oil circuit 30 is carried out between the annular wall 27 and 28.

[0023] Differential equipment 1 has a flange yoke 34. This flange yoke 34 has a drum section 35 and the flange 36 formed in this drum section 35 in one. A drum section 35 is attached outside the side other than the shank 9 of the pinion shaft 7 (i.e., a non-illustrated drive shaft). The shield 37 is infixed between the 1 side-edge side of a drum section 35, and inner-ring-of-spiral-wound-gasket member 14 end face of a tapered roller bearing 25. Oil seal 38 is arranged between the peripheral face of a drum section 35, and side opening inner skin besides the front case 3. Oil seal 38 is attached in the seal protection cup 39 of a wrap sake by side opening besides the front case 3. The thread part 40 was formed in the side heel besides a shank 9, and this thread part 40 is projected to the central crevice 41 of a flange 36. The nut 42 is screwed on the thread part 40.

[0024] Thus, by screwing a nut 42 on a thread part 40, and making the plastic spacer 33 transform Both the inner-rings-of-spiral-wound-gasket members 13A and 13B of the double row ball bearing 10 and the

inner-ring-of-spiral-wound-gasket member 14 of a tapered roller bearing 25 are put in the direction of an axial center by the end face of a pinion gear 6, and the end face of a flange yoke 34, and mind a shield 37 and the plastic spacer 33. It is in the condition that predetermined precompression was given to the balls 17 and 18 of the double row ball bearing 10, and the tapered roller 26 of a tapered roller bearing 25.

[0025] In the differential equipment 1 of the above-mentioned configuration, the oil 43 for lubrication is stored on level L in the shutdown condition in differential casing 2. Oil 43 is drawn so that it may have bounded with rotation of a ring wheel 8 at the time of operation and the upper part of the double row ball bearing 10 and a tapered roller bearing 25 may be supplied through the oil circuit 30 within the front case 3, and it circulates through the inside of differential casing 2 so that the lubrication of the double row ball bearing 10 and the tapered roller bearing 25 may be carried out.

[0026] Next, the assembly approach of such differential equipment 1 is explained. On the occasion of \*\*\*\*\*, the double row ball bearing 10 is assembled for differential equipment 1. That is, when attaching the second assembly 22 to the outer-ring-of-spiral-wound-gasket member 11, the ball 18 in the minor diameter orbit side ball group 16 chooses the ball 18 of minor diameter orbit side inner-ring-of-spiral-wound-gasket member 13B and the minor diameter orbit side ball group 16, and it is made to attach to minor diameter orbit side inner-ring-of-spiral-wound-gasket member 13B in the condition of having made this minor diameter orbit side ball group 16 holding to the second cage 20 so that it may become the predetermined contact angle  $\theta_1$  as shown in drawing 3.

[0027] Then, in order to choose the first assembly 21, a fixture 45 is used and the \*\*\*\* distance 46 is measured. In this \*\*\*\* distance 46, it is the direction distance of an axial center to contact predetermined position 17c to which the ball 17 of the major-diameter orbit side ball group 15 contacts major-diameter outer-ring-of-spiral-wound-gasket orbital plane 17b from end-face 13b of minor diameter orbit side inner-ring-of-spiral-wound-gasket member 13B in the second assembly 22 already attached to the outer-ring-of-spiral-wound-gasket member 11. That is, make the tip of the end-face contact section 47 of a fixture 45 contact end-face 13b of minor diameter orbit side inner-ring-of-spiral-wound-gasket member 13B from an axial center, the tip of the orbital contact section 48 of a fixture 45 is made to contact contact predetermined position 17c in major-diameter outer-ring-of-spiral-wound-gasket orbital plane 17b from an axial center, and the \*\*\*\* distance 46 is detected.

[0028] Then, based on the \*\*\*\* distance 46 found as mentioned above, ball [ used as the proper contact angle  $\theta_2$  according to the predetermined contact angle  $\theta_1$  in the ball 18 of the minor diameter orbit side ball group 16 ] 17 and major-diameter orbit side inner-ring-of-spiral-wound-gasket member 13A is chosen, where the major-diameter orbit side ball group 15 is held with the first cage 19, it attaches to major-diameter orbit side inner-ring-of-spiral-wound-gasket member 13A, and it considers as the first assembly 21. Thus, the first suitable assembly 21 and second suitable assembly 22 are chosen to the outer-ring-of-spiral-wound-gasket member 11.

[0029] Next, the outer-ring-of-spiral-wound-gasket member 11 in the double row ball bearing 10 is included in the front case 3 in the condition of having made the front case 3 and the rear case 4 still separating. At this time, the outer-ring-of-spiral-wound-gasket member 11 is pressed fit to the direction of axial center predetermined location equivalent to the step currently formed in the annular wall 27 from 1 side opening of the front case 3. Moreover, the outer-ring-of-spiral-wound-gasket member 12 of a tapered roller bearing 25 is pressed fit to the direction of axial center predetermined location which hits the step currently formed in the annular wall 28 from side opening besides the front case 3.

[0030] Apart from this, the first assembly 21 and second assembly 22 are attached to the shank 9 of the pinion shaft 7. Namely, as major-diameter orbit side inner-ring-of-spiral-wound-gasket member 13A and minor diameter orbit side inner-ring-of-spiral-wound-gasket member 13B are inserted in the shank 9 of the pinion shaft 7, the first assembly 21 and second assembly 22 are located in the pinion gear 6 side of the shank 9 of the pinion shaft 7.

[0031] From the minor diameter side, the pinion shaft 7 which attached the first assembly 21 and second assembly 22 as mentioned above is inserted so that the ball 18 of the second assembly 22 may fit into minor diameter outer-ring-of-spiral-wound-gasket orbital plane 18b of the outer-ring-of-spiral-wound-gasket member 11 from 1 side opening of the front case 3, and so that the ball 17 of the first assembly 21 may fit into major-diameter outer-ring-of-spiral-wound-gasket orbital plane 17b of the outer-ring-of-spiral-wound-gasket member 11. By this, it will be attached from direction of axial center said to the outer-ring-of-spiral-wound-gasket member 11, major-diameter orbit side inner-ring-of-spiral-wound-gasket member 13A and minor diameter orbit side inner-ring-of-spiral-wound-gasket member 13B will counter the outer-ring-of-spiral-wound-gasket member 11 at the direction inside of a path, and the ball 17 of the first assembly 21 and the ball 18 of the second assembly 22 will be installed in the direction of an axial center.

[0032] Next, outer fitting insertion of the plastic spacer 33 is carried out from side opening besides the



front case 3 at the shank 9 of the pinion shaft 7. Then, the shank 9 of the pinion shaft 7 is equipped with the assembly of the inner-ring-of-spiral-wound-gasket member 14 in a tapered roller bearing 25, cage 25a, and a tapered roller 26 from side opening besides the front case 3. In this case, while inserting the inner-ring-of-spiral-wound-gasket member 14 of that assembly in the shank 9 of the pinion shaft 7, a tapered roller 26 is made to fit into the outer-ring-of-spiral-wound-gasket orbital plane of the outer-ring-of-spiral-wound-gasket member 12.

[0033] Then, a shield 37 is inserted in the shank 9 of the pinion shaft 7 from side opening besides the front case 3, it equips with oil seal 38, the seal protection cup 39 is attached in side opening besides the front case 3, the drum section 35 of a flange yoke 34 is inserted in the seal protection cup 39, and the end face is made to contact a shield 37. Then, predetermined precompression is given to the balls 17 and 18 of both the trains in the first assembly 21 and second assembly 22 of the double row ball bearing 10, and the tapered roller 26 of a tapered roller bearing 25 by screwing a nut 42 on the thread part 40 of a shank 9, and making the plastic spacer 33 transform.

[0034] Since it is set up beforehand and the second assembly 22 is chosen so that the contact angle  $\theta_2$  of the ball [ in / as mentioned above / at this time / the second assembly 22 ] 17 may become proper to the contact angle  $\theta_1$  of the ball 18 in the first assembly 21, the contact angle  $\theta_1$  of a ball 18 at the time of screwing a nut 42 on the thread part 40 of a shank 9 and the contact angle  $\theta_2$  of a ball 17 serve as a proper value.

[0035] Moreover, since the double row ball bearing 10 is assembled by including after choosing the first assembly 21 and second assembly 22 which it is suitable for this, and also contain the bearing washer and ball of a way, one single bearing washer 11, i.e., outer-ring-of-spiral-wound-gasket member. Precompression can be given to an equally near positive and condition to the ball 17 in the first assembly 21, and the ball 18 in the second assembly 22 by screwing a nut 42 on the thread part 40 of a shank 9, and the double row ball bearing 10 which held required rigidity by this is obtained.

[0036] The double row ball bearing 10 with small frictional resistance is used as anti-friction bearing by the side of the pinion gear 6 which big thrust loading furthermore commits with this operation gestalt. Thereby, compared with the tapered roller bearing used conventionally, running torque can become small and can raise the effectiveness of differential equipment 1. And by having used the not a ball bearing but double row ball bearing 10 of a single row, load-carrying capacity can be enlarged compared with the ball bearing of a single row, and sufficient support rigidity is acquired.

[0037] In addition, by having used the double row ball bearing 10 of the tandem die which enlarged the pitch diameter D1 of the minor diameter orbit side ball group 15 by the side of a pinion gear 6 as a double row ball bearing 10 compared with the pitch diameter D2 of the major-diameter orbit side ball group 16 If the balls 17 and 18 of both trains are the diameters of said, the number of the balls 17 in the minor diameter orbit side ball group 16 by the side of the pinion gear 6 which bigger thrust loading commits can be made to increase, and it will become the double row anti-friction bearing 10 which can bear a big load for this reason.

[0038] Moreover, although the above-mentioned double row anti-friction bearing is used suitable for the bearing for pinion shaft support of the differential equipment of a car, it is not limited to this. That is, if it is equipment of a configuration of that attach other component parts of double row anti-friction bearing to another side of a shaft or housing by attaching the bearing washer, and while it is the component part of double row anti-friction bearing inserts in a shaft to housing, it is applicable to either a shaft or housing.

[0039] In this case, considering the first assembly 21 and second assembly 22 as a configuration which is attached from an axial center opposite direction to the outer-ring-of-spiral-wound-gasket member 11 irrespective of the size of a pitch diameter is also considered.

[0040]

[Effect of the Invention] According to this invention a passage clear from the above explanation, each contact angle of the rolling element of each train in double row anti-friction bearing can be easily made into a proper value, and management of the precompression to the rolling element of each train becomes easy.

---

[Translation done.]

\* NOTICES \*

JPO and INPIT are not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.\*\*\*\* shows the word which can not be translated.

3.In the drawings, any words are not translated.

---

TECHNICAL FIELD

---

[Field of the Invention] This invention relates to double row anti-friction bearing used for the differential equipment carried in a car, and its assembly approach.

---

[Translation done.]



## \* NOTICES \*

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

PRIOR ART

---

[Description of the Prior Art] Drawing 4 shows the cross-section structure of conventional differential equipment 100. This differential equipment 100 has differential casing 101. The pinion shaft (drive pinion) 102 is arranged in this differential casing 101. This pinion shaft 102 is supported by the tapered roller bearing 103,104 of the pair single row estranged and arranged in the direction of an axial center free [ rotation ] at the circumference of an axial center. The flange yoke 105 connected with a non-illustrated driveshaft is formed in the edge of the pinion shaft 102.

---

[Translation done.]

## \* NOTICES \*

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

EFFECT OF THE INVENTION

---

[Effect of the Invention] According to this invention a passage clear from the above explanation, each contact angle of the rolling element of each train in double row anti-friction bearing can be easily made into a proper value, and management of the precompression to the rolling element of each train becomes easy.

---

[Translation done.]

## \* NOTICES \*

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

TECHNICAL PROBLEM

---

[Problem(s) to be Solved by the Invention] With the above-mentioned differential equipment 100, the bearing supported for the pinion shaft 102, enabling free rotation consists of a tapered roller bearing 103,104. Especially, big frictional resistance works to the tapered roller bearing 103 by the side of the big pinion gear 106 of thrust loading. For this reason, running torque becomes large and the technical problem that the effectiveness of differential equipment 100 falls occurs. Then, it is possible to replace the bearing by the side of a pinion gear 106 with a tapered roller bearing 103, and to use the double row ball bearing of a tandem die.

[0004] As mentioned above, when it replaced with a tapered roller bearing 103 and the double row ball bearing of a tandem die was used, there was no double row ball bearing which is difficult for using the ball of both trains as a proper contact angle, is stabilized as differential equipment 100 by the difference in a dimensional tolerance etc., and can demonstrate the desired engine performance.

---

[Translation done.]

## \* NOTICES \*

JPO and INPIT are not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.\*\*\*\* shows the word which can not be translated.

3.In the drawings, any words are not translated.

---

MEANS

---

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, double row anti-friction bearing of this invention While being arranged to this alignment within and without the direction of a path, it has a bearing washer and an another side bearing washer. The aforementioned one side bearing washer It is the single bearing washer which has a minor diameter orbit and a major-diameter orbit in the peripheral surface. Said another side bearing washer A single minor diameter orbit side bearing washer with the orbit which counters said minor diameter orbit to a peripheral surface. A single major-diameter orbit side bearing washer with the orbit which counters said major-diameter orbit is included in a peripheral surface. Said minor diameter orbit side rolling-element group by which fitting is carried out on the other hand between the minor diameter orbit of a bearing washer, and the orbit of said minor diameter orbit side bearing washer. It has said major-diameter orbit side rolling-element group by which fitting is carried out on the other hand between the major-diameter orbit of a bearing washer, and the orbit of a major-diameter orbit side bearing washer. Said minor diameter orbit side rolling-element group and a minor diameter orbit side bearing washer are attached to the aforementioned one side bearing washer from an axial center. And on the other hand, said major-diameter orbit side rolling-element group and a major-diameter orbit side bearing washer are attached to a bearing washer from an axial center, and said minor diameter orbit side bearing washer and the major-diameter orbit side bearing washer are installed in the direction of an axial center.

[0006] According to the above-mentioned configuration, setting management of the contact angle of each rolling-element group becomes easy by choosing beforehand the major-diameter orbit side rolling-element group which serves as a proper contact angle to the contact angle of a minor diameter orbit side rolling-element group, and a major-diameter orbit side bearing washer.

[0007] While double row anti-friction bearing of the above-mentioned configuration builds said minor diameter orbit side bearing washer into said single bearing washer from an axial center While fitting in said minor diameter orbit side rolling-element group between the minor diameter orbit of said single bearing washer, and the orbit of said minor diameter orbit side bearing washer and building said major-diameter orbit side bearing washer into said single bearing washer from an axial center Said major-diameter orbit side rolling-element group is assembled as it fits in between the major-diameter orbit of said single bearing washer, and the orbit of said major-diameter orbit side bearing washer.

[0008] Still more preferably double row anti-friction bearing of the above-mentioned configuration The end-face location of said minor diameter orbit side bearing washer beforehand built into said single bearing washer with said minor diameter orbit side rolling-element group. It is based on the direction distance of an axial center with the contact predetermined position in contact with the major-diameter orbit of said major-diameter orbit side rolling-element group. The major-diameter orbit side rolling-element group from which the contact angle of said major-diameter orbit side rolling-element group turns into a proper contact angle to the contact angle of said minor diameter orbit side rolling-element group, and a major-diameter orbit side bearing washer are chosen, and it assembles by building these major-diameters orbit side rolling-element group and a major-diameter orbit side bearing washer into said single bearing washer.

[0009]

[Embodiment of the Invention] The case where double row anti-friction bearing (henceforth a "double row ball bearing") of this invention is made to apply to the bearing for pinion shaft support of the differential equipment attached to a car hereafter is explained to an example based on a drawing.

[0010] The sectional view of the double row ball bearing part after the assembly of differential equipment and drawing 3 of the sectional view in which drawing 1 shows the outline configuration of differential equipment, and drawing 2 are the explanatory views in the middle of the assembly of differential

equipment.

[0011] As shown in drawing 1 , said differential equipment 1 has differential casing 2. This differential casing 2 consists of a front case 3 and a rear case 4, and both 3 and 4 are attached by bolt nut 2a. Among the front cases 3, the annular walls 27 and 28 for bearing wearing are formed in the way. This differential casing 2 is carrying out the interior of the pinion shaft (drive pinion) 7 which has a pinion gear 6 to the differential change gear style [ which carries out differential linkage of the wheel on either side ] 5, and 1 side. The pinion gear 6 has geared to the ring wheel 8 of the differential change gear style 5. The shank 9 of the pinion shaft 7 is formed in the shape of a stage so that the side else may serve as a minor diameter compared with 1 side.

[0012] The shank 9 of the pinion shaft 7 is supported by the annular wall 27 of the front case 3 free [ rotation ] through the double row ball bearing 10 in the 1 side at the circumference of an axial center. In addition to this, the shank 9 of the pinion shaft 7 is supported by the annular wall 28 of the front case 3 free [ rotation ] through the tapered roller bearing 25 at the circumference of an axial center in the side.

[0013] As shown in drawing 3 , while has major-diameter outer-ring-of-spiral-wound-gasket orbital plane 17b and minor diameter outer-ring-of-spiral-wound-gasket orbital plane 18b, and the double row ball bearing 10 consists of an outer-ring-of-spiral-wound-gasket member 11, and the first assembly 21 and second assembly 22 as a single bearing washer. The double row ball bearing 10 consists of attaching so that the first assembly 21 and second assembly 22 may be installed in the direction of an axial center to the outer-ring-of-spiral-wound-gasket member 11 at the direction inside of a path.

[0014] The outer-ring-of-spiral-wound-gasket member 11 is attached in the inner skin of the annular wall 27. The counter-bored outer ring is used as an outer-ring-of-spiral-wound-gasket member 11. Flat-surface section 11b which follows minor diameter outer-ring-of-spiral-wound-gasket orbital plane 18b in a minor diameter from major-diameter outer-ring-of-spiral-wound-gasket orbital plane 17b between major-diameter outer-ring-of-spiral-wound-gasket orbital plane 17b and minor diameter outer-ring-of-spiral-wound-gasket orbital plane 18b is formed in this outer-ring-of-spiral-wound-gasket member 11. Of this configuration, the inner skin of the outer-ring-of-spiral-wound-gasket member 11 is formed in the shape of a stage.

[0015] The first assembly 21 has the major-diameter orbit side ball group 15 which fits in between single major-diameter orbit side inner-ring-of-spiral-wound-gasket member 13A of another side which counters major-diameter outer-ring-of-spiral-wound-gasket orbital plane 17b of the outer-ring-of-spiral-wound-gasket member 11 in the direction of a path, and has inner-ring-of-spiral-wound-gasket orbital plane 17a, and major-diameter outer-ring-of-spiral-wound-gasket orbital plane 17b and inner-ring-of-spiral-wound-gasket orbital plane 17a. This major-diameter orbit side ball group 15 is held by the first cage 19 at \*\*\*\*\*, such as a circumferential direction. As this major-diameter orbit side inner-ring-of-spiral-wound-gasket member 13A, the shoulder dropping inner ring of spiral wound gasket is used.

[0016] The second assembly 22 has the minor diameter orbit side ball group 16 which fits in between single minor diameter orbit side inner-ring-of-spiral-wound-gasket member 13B which has inner-ring-of-spiral-wound-gasket orbital plane 18a which counters minor diameter outer-ring-of-spiral-wound-gasket orbital plane 18b of the outer-ring-of-spiral-wound-gasket member 11 in the direction of a path, and minor diameter outer-ring-of-spiral-wound-gasket orbital plane 18b and inner-ring-of-spiral-wound-gasket orbital plane 18a. This minor diameter orbit side ball group 16 is held by the second cage 20 at \*\*\*\*\*, such as a circumferential direction.

[0017] As minor diameter orbit side inner-ring-of-spiral-wound-gasket member 13B, the shoulder dropping inner ring of spiral wound gasket of a minor diameter is relatively used compared with major-diameter orbit side inner-ring-of-spiral-wound-gasket member 13A. The path of the shoulder of minor diameter orbit side inner-ring-of-spiral-wound-gasket member 13B is formed in the major diameter rather than the path of the shoulder dropping section of major-diameter orbit side inner-ring-of-spiral-wound-gasket member 13A.

[0018] Major-diameter orbit side inner-ring-of-spiral-wound-gasket member 13A is inserted in the pinion shaft 7 (eye \*\*\*\*\*). The end face in major-diameter orbit side inner-ring-of-spiral-wound-gasket member 13A is in contact with the end face of a pinion gear 6 from an axial center. Minor diameter orbit side inner-ring-of-spiral-wound-gasket member 13B is inserted in the pinion shaft 7.

[0019] The path of the ball 17 in the major-diameter orbit side ball group 15 is formed in size from the path of the ball 18 in the minor diameter orbit side ball group 16. Such double row ball bearings 10 of a configuration differ in the pitch diameters D1 and D2 of each ball groups 15 and 16, respectively. That is, the pitch diameter D1 of the major-diameter orbit side ball group 15 is set up more greatly than the pitch diameter D2 of the minor diameter orbit side ball group 16. Thus, the double row ball bearing 10 which has the ball groups 15 and 16 from which pitch diameters D1 and D2 differ is called the double row ball bearing of a tandem die.

[0020] A tapered roller bearing 25 has two or more the tapered rollers 26 of a single row and cage 25a which holds these tapered rollers 26 to \*\*\*\*\*, such as a circumferential direction, infixed between the outer-ring-of-spiral-wound-gasket member 12 of a single, the inner-ring-of-spiral-wound-gasket member 14 of the single arranged at the method of the inside of the direction of a path of this outer-ring-of-spiral-wound-gasket member 12, and the outer-ring-of-spiral-wound-gasket member 12 and the inner-ring-of-spiral-wound-gasket member 14. The outer-ring-of-spiral-wound-gasket member 12 in a tapered roller bearing 25 is attached in the inner skin of the annular wall 28. More than one are the inner-ring-of-spiral-wound-gasket member 14, cage 25a, and the thing by which the outer-ring-of-spiral-wound-gasket member 12 is independently used as an assembly, and the tapered roller 26 of a single row is attached to the outer-ring-of-spiral-wound-gasket member 12. The outer-ring-of-spiral-wound-gasket orbital plane of a tapered roller 26 is formed in the inner skin of the outer-ring-of-spiral-wound-gasket member 12, and the inner-ring-of-spiral-wound-gasket orbital plane of a tapered roller 26 is formed in the peripheral face of the inner-ring-of-spiral-wound-gasket member 14, respectively. The inner-ring-of-spiral-wound-gasket member 14 of a tapered roller bearing 25 is inserted in in the middle of the shank 9 of the pinion shaft 7.

[0021] The plastic spacer 33 for a precompression setup is infixed in edge face-to-face in the direction of an axial center of minor diameter orbit side inner-ring-of-spiral-wound-gasket member 13B of the double row ball bearing 10, and the inner-ring-of-spiral-wound-gasket member 14 of a tapered roller bearing 25. Outer fitting of this plastic spacer 33 is carried out in the middle of the shank 9 of the pinion shaft 7.

[0022] The oil circuit 30 is formed between the outer wall of the front case 3, and the annular wall 27 by the side of one, opening of the oil inlet port 31 of this oil circuit 30 is carried out to the ring wheel 8 side of the oil circuit 30, and opening of the oil outlet 32 of the oil circuit 30 is carried out between the annular wall 27 and 28.

[0023] Differential equipment 1 has a flange yoke 34. This flange yoke 34 has a drum section 35 and the flange 36 formed in this drum section 35 in one. A drum section 35 is attached outside the side other than the shank 9 of the pinion shaft 7 (i.e., a non-illustrated drive shaft). The shield 37 is infixed between the 1 side-edge side of a drum section 35, and inner-ring-of-spiral-wound-gasket member 14 end face of a tapered roller bearing 25. Oil seal 38 is arranged between the peripheral face of a drum section 35, and side opening inner skin besides the front case 3. Oil seal 38 is attached in the seal protection cup 39 of a wrap sake by side opening besides the front case 3. The thread part 40 was formed in the side heel besides a shank 9, and this thread part 40 is projected to the central crevice 41 of a flange 36. The nut 42 is screwed on the thread part 40.

[0024] Thus, by screwing a nut 42 on a thread part 40, and making the plastic spacer 33 transform Both the inner-rings-of-spiral-wound-gasket members 13A and 13B of the double row ball bearing 10 and the inner-ring-of-spiral-wound-gasket member 14 of a tapered roller bearing 25 are put in the direction of an axial center by the end face of a pinion gear 6, and the end face of a flange yoke 34, and mind a shield 37 and the plastic spacer 33. It is in the condition that predetermined precompression was given to the balls 17 and 18 of the double row ball bearing 10, and the tapered roller 26 of a tapered roller bearing 25.

[0025] In the differential equipment 1 of the above-mentioned configuration, the oil 43 for lubrication is stored on level L in the shutdown condition in differential casing 2. Oil 43 is drawn so that it may have bounded with rotation of a ring wheel 8 at the time of operation and the upper part of the double row ball bearing 10 and a tapered roller bearing 25 may be supplied through the oil circuit 30 within the front case 3, and it circulates through the inside of differential casing 2 so that the lubrication of the double row ball bearing 10 and the tapered roller bearing 25 may be carried out.

[0026] Next, the assembly approach of such differential equipment 1 is explained. On the occasion of \*\*\*\*\*, the double row ball bearing 10 is assembled for differential equipment 1. That is, when attaching the second assembly 22 to the outer-ring-of-spiral-wound-gasket member 11, the ball 18 in the minor diameter orbit side ball group 16 chooses the ball 18 of minor diameter orbit side inner-ring-of-spiral-wound-gasket member 13B and the minor diameter orbit side ball group 16, and it is made to attach to minor diameter orbit side inner-ring-of-spiral-wound-gasket member 13B in the condition of having made this minor diameter orbit side ball group 16 holding to the second cage 20 so that it may become the predetermined contact angle  $\theta_1$  as shown in drawing 3.

[0027] Then, in order to choose the first assembly 21, a fixture 45 is used and the \*\*\*\* distance 46 is measured. In this \*\*\*\* distance 46, it is the direction distance of an axial center to contact predetermined position 17c to which the ball 17 of the major-diameter orbit side ball group 15 contacts major-diameter outer-ring-of-spiral-wound-gasket orbital plane 17b from end-face 13b of minor diameter orbit side inner-ring-of-spiral-wound-gasket member 13B in the second assembly 22 already attached to the outer-ring-of-spiral-wound-gasket member 11. That is, make the tip of the end-face contact section 47

of a fixture 45 contact end-face 13b of minor diameter orbit side inner-ring-of-spiral-wound-gasket member 13B from an axial center, the tip of the orbital contact section 48 of a fixture 45 is made to contact contact predetermined position 17c in major-diameter outer-ring-of-spiral-wound-gasket orbital plane 17b from an axial center, and the \*\*\*\* distance 46 is detected.

[0028] Then, based on the \*\*\*\* distance 46 found as mentioned above, ball [ used as the proper contact angle theta 2 according to the predetermined contact angle theta 1 in the ball 18 of the minor diameter orbit side ball group 16 ] 17 and major-diameter orbit side inner-ring-of-spiral-wound-gasket member 13A is chosen, where the major-diameter orbit side ball group 15 is held with the first cage 19, it attaches to major-diameter orbit side inner-ring-of-spiral-wound-gasket member 13A, and it considers as the first assembly 21. Thus, the first suitable assembly 21 and second suitable assembly 22 are chosen to the outer-ring-of-spiral-wound-gasket member 11.

[0029] Next, the outer-ring-of-spiral-wound-gasket member 11 in the double row ball bearing 10 is included in the front case 3 in the condition of having made the front case 3 and the rear case 4 still separating. At this time, the outer-ring-of-spiral-wound-gasket member 11 is pressed fit to the direction of axial center predetermined location equivalent to the step currently formed in the annular wall 27 from 1 side opening of the front case 3. Moreover, the outer-ring-of-spiral-wound-gasket member 12 of a tapered roller bearing 25 is pressed fit to the direction of axial center predetermined location which hits the step currently formed in the annular wall 28 from side opening besides the front case 3.

[0030] Apart from this, the first assembly 21 and second assembly 22 are attached to the shank 9 of the pinion shaft 7. Namely, as major-diameter orbit side inner-ring-of-spiral-wound-gasket member 13A and minor diameter orbit side inner-ring-of-spiral-wound-gasket member 13B are inserted in the shank 9 of the pinion shaft 7, the first assembly 21 and second assembly 22 are located in the pinion gear 6 side of the shank 9 of the pinion shaft 7.

[0031] From the minor diameter side, the pinion shaft 7 which attached the first assembly 21 and second assembly 22 as mentioned above is inserted so that the ball 18 of the second assembly 22 may fit into minor diameter outer-ring-of-spiral-wound-gasket orbital plane 18b of the outer-ring-of-spiral-wound-gasket member 11 from 1 side opening of the front case 3, and so that the ball 17 of the first assembly 21 may fit into major-diameter outer-ring-of-spiral-wound-gasket orbital plane 17b of the outer-ring-of-spiral-wound-gasket member 11. By this, it will be attached from direction of axial center said to the outer-ring-of-spiral-wound-gasket member 11, major-diameter orbit side inner-ring-of-spiral-wound-gasket member 13A and minor diameter orbit side inner-ring-of-spiral-wound-gasket member 13B will counter the outer-ring-of-spiral-wound-gasket member 11 at the direction inside of a path, and the ball 17 of the first assembly 21 and the ball 18 of the second assembly 22 will be installed in the direction of an axial center.

[0032] Next, outer fitting insertion of the plastic spacer 33 is carried out from side opening besides the front case 3 at the shank 9 of the pinion shaft 7. Then, the shank 9 of the pinion shaft 7 is equipped with the assembly of the inner-ring-of-spiral-wound-gasket member 14 in a tapered roller bearing 25, cage 25a, and a tapered roller 26 from side opening besides the front case 3. In this case, while inserting the inner-ring-of-spiral-wound-gasket member 14 of that assembly in the shank 9 of the pinion shaft 7, a tapered roller 26 is made to fit into the outer-ring-of-spiral-wound-gasket orbital plane of the outer-ring-of-spiral-wound-gasket member 12.

[0033] Then, a shield 37 is inserted in the shank 9 of the pinion shaft 7 from side opening besides the front case 3, it equips with oil seal 38, the seal protection cup 39 is attached in side opening besides the front case 3, the drum section 35 of a flange yoke 34 is inserted in the seal protection cup 39, and the end face is made to contact a shield 37. Then, predetermined precompression is given to the balls 17 and 18 of both the trains in the first assembly 21 and second assembly 22 of the double row ball bearing 10, and the tapered roller 26 of a tapered roller bearing 25 by screwing a nut 42 on the thread part 40 of a shank 9, and making the plastic spacer 33 transform.

[0034] Since it is set up beforehand and the second assembly 22 is chosen so that the contact angle theta 2 of the ball [ in / as mentioned above / at this time / the second assembly 22 ] 17 may become proper to the contact angle theta 1 of the ball 18 in the first assembly 21, the contact angle theta 1 of a ball 18 at the time of screwing a nut 42 on the thread part 40 of a shank 9 and the contact angle theta 2 of a ball 17 serve as a proper value.

[0035] Moreover, since the double row ball bearing 10 is assembled by including after choosing the first assembly 21 and second assembly 22 which it is suitable for this, and also contain the bearing washer and ball of a way, one single bearing washer 11, i.e., outer-ring-of-spiral-wound-gasket member Precompression can be given to an equally near positive and condition to the ball 17 in the first assembly 21, and the ball 18 in the second assembly 22 by screwing a nut 42 on the thread part 40 of a shank 9, and the double row ball bearing 10 which held required rigidity by this is obtained.



[0036] The double row ball bearing 10 with small frictional resistance is used as anti-friction bearing by the side of the pinion gear 6 which big thrust loading furthermore commits with this operation gestalt. Thereby, compared with the tapered roller bearing used conventionally, running torque can become small and can raise the effectiveness of differential equipment 1. And by having used the not a ball bearing but double row ball bearing 10 of a single row, load-carrying capacity can be enlarged compared with the ball bearing of a single row, and sufficient support rigidity is acquired.

[0037] In addition, by having used the double row ball bearing 10 of the tandem die which enlarged the pitch diameter D1 of the minor diameter orbit side ball group 15 by the side of a pinion gear 6 as a double row ball bearing 10 compared with the pitch diameter D2 of the major-diameter orbit side ball group 16 If the balls 17 and 18 of both trains are the diameters of said, the number of the balls 17 in the minor diameter orbit side ball group 16 by the side of the pinion gear 6 which bigger thrust loading commits can be made to increase, and it will become the double row anti-friction bearing 10 which can bear a big load for this reason.

[0038] Moreover, although the above-mentioned double row anti-friction bearing is used suitable for the bearing for pinion shaft support of the differential equipment of a car, it is not limited to this. That is, if it is equipment of a configuration of that attach other component parts of double row anti-friction bearing to another side of a shaft or housing by attaching the bearing washer, and while it is the component part of double row anti-friction bearing inserts in a shaft to housing, it is applicable to either a shaft or housing.

[0039] In this case, considering the first assembly 21 and second assembly 22 as a configuration which is attached from an axial center opposite direction to the outer-ring-of-spiral-wound-gasket member 11 irrespective of the size of a pitch diameter is also considered.

---

[Translation done.]

## \* NOTICES \*

JPO and INPIT are not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.\*\*\* shows the word which can not be translated.

3.In the drawings, any words are not translated.

---

DESCRIPTION OF DRAWINGS

---

[Brief Description of the Drawings]

[Drawing 1] It is the sectional view showing the whole differential equipment configuration which shows the first operation gestalt of this invention.

[Drawing 2] Similarly it is an important section expanded sectional view.

[Drawing 3] It is the sectional view showing the condition in the middle of attachment of a double row ball bearing similarly.

[Drawing 4] It is the sectional view showing the whole differential equipment configuration which shows the conventional example.

[Description of Notations]

1 Differential Equipment

7 Pinion Shaft

10 Double Row Ball Bearing

11 Outer-Ring-of-Spiral-Wound-Gasket Member

13A The first inner-ring-of-spiral-wound-gasket member

13B The second inner-ring-of-spiral-wound-gasket member

15 Major-Diameter Orbit Side Ball Group

16 Minor Diameter Orbit Side Ball Group

17a Inner-ring-of-spiral-wound-gasket orbital plane

17b Major-diameter outer-ring-of-spiral-wound-gasket orbital plane

18a Inner-ring-of-spiral-wound-gasket orbital plane

18b Minor diameter outer-ring-of-spiral-wound-gasket orbital plane

21 First Assembly

22 Second Assembly

25 Tapered Roller Bearing

27 Annular Wall

34 Flange Yoke

D1 Pitch diameter

D2 Pitch diameter

---

[Translation done.]

## \* NOTICES \*

JPO and INPIT are not responsible for any damages caused by the use of this translation.

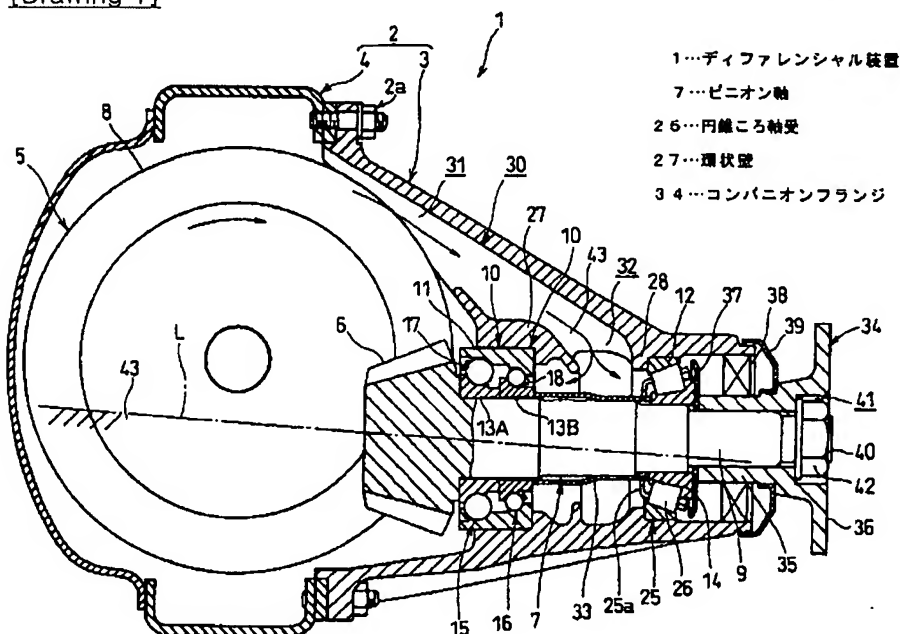
1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.\*\*\*\* shows the word which can not be translated.

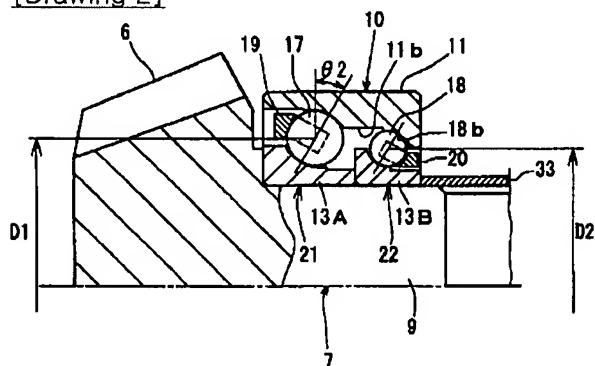
3.In the drawings, any words are not translated.

## DRAWINGS

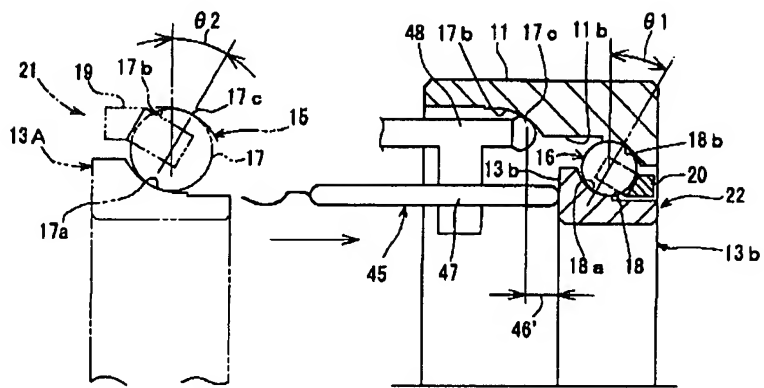
[Drawing 1]



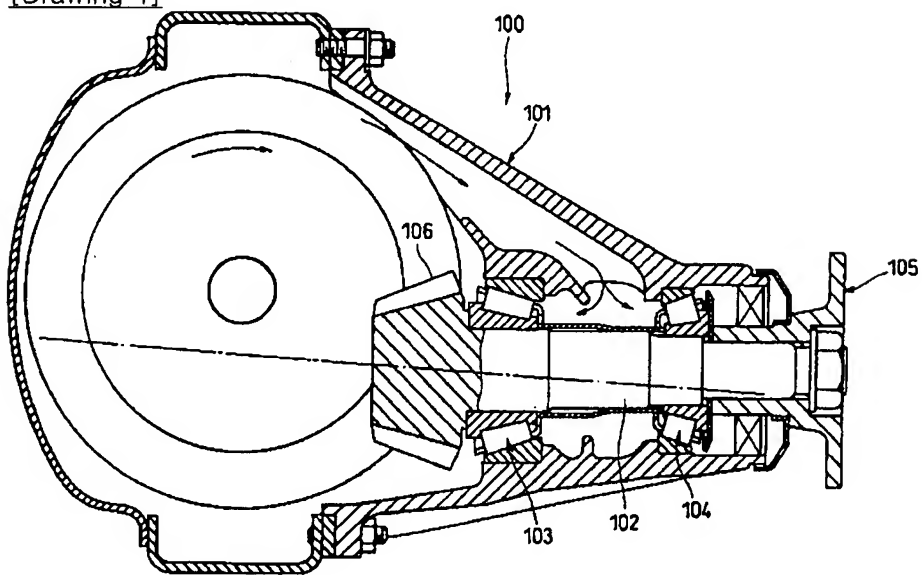
[Drawing 2]



[Drawing 3]



[Drawing 4]



[Translation done.]